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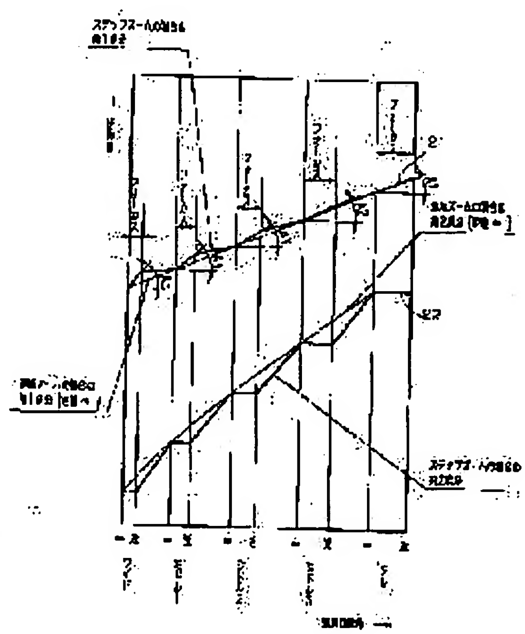
(54) ZOOM CAMERA

(57)Abstract:
PROBLEM TO BE SOLVED: To make the moving amount of a focal position with respect to a fixed lens barrel rotational angle nearly equal in all the zoom area in a zoom camera adopting a zoom focus integrated driving system.
SOLUTION: This zoom camera is equipped with a zoom focus integrated driving type zoom lens barrel where plural lens groups are respectively moved on one zoom line alternately including plural focusing sections and plural zooming sections. In the camera, two opposed lens groups whose variation in the unit of the relative distance most largely influences the moving amount of the focal position are constituted so that the changing rate of the relative distance of both lens groups to the fixed lens barrel rotational angle in each focusing section gets smaller toward the focusing section on a telephoto side.



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CLAIMS

[Claim(s)]
[Claim 1] In the zoom camera really [zoom focus] moves in the one zoom line top which includes the zooming section of two or more focusing sections and plurality respectively of two or more lens groups by turns equipped with the drive mold zoom lens camera cone About two lens groups to which the variation of the unit of the relative distance has biggest effect on the amount of focus impaction efficiency and which counter The zoom camera characterized by the rate of change of the relative distance of both the lens group to the fixed camera cone angle of rotation in each focusing section constituting so that the focusing section by the side of a call may become small.
[Claim 2] The zoom lens camera according to claim 1 characterized by equipping the above-mentioned zoom lens camera cone with two lens groups.
[Claim 3] The zoom lens camera according to claim 1 which the above-mentioned zoom lens camera cone is equipped with three lens groups, and is characterized by two lens groups other than the lens group most located in a photographic subject side being the two above-mentioned lens groups.
[Claim 4] In the zoom camera really [zoom focus] moves in the one zoom line top which includes the zooming section of two or more focusing sections and plurality respectively of two or more lens groups by turns equipped with the drive mold zoom lens camera cone About two lens groups to which the variation of the unit of the relative distance has biggest effect on the amount of focus impaction efficiency and which counter The approach the rate of change of the relative distance of both the lens group to the fixed camera cone angle of rotation in each focusing section constitutes so that the focusing section by the side of a call may become small, and it makes regularity mostly the amount of focus impaction efficiency to a fixed camera cone angle of rotation in all zoom regions by this.
[Claim 5] In the zoom camera really [zoom focus] moves in the one zoom line top which includes the zooming section of two or more focusing sections and plurality respectively of two or more lens groups by turns equipped with the drive mold zoom lens camera cone The zoom camera characterized by constituting the zoom line of each lens group so that the amount of focus impaction efficiency to a fixed camera cone angle of rotation may become almost fixed in all zoom regions and each lens group may move.
[Claim 6] In the zoom camera really [zoom focus] moves in the one zoom line top which includes the zooming section of two or more focusing sections and plurality respectively of two or more lens groups by turns equipped with the drive mold zoom lens camera cone The zoom camera characterized by constituting the zoom line of each lens group so that the amount obtained by **(ing) the amount of focus impaction efficiency to a fixed camera cone angle of rotation with the F value of the zoom lens concerned may become almost fixed in all zoom regions and each lens group may move.

[Translation done.]

* NOTICES *

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the camera of the zoom focus type which performs zooming and focusing with a single drive.
[0002]
[Description of the Prior Art] The drive is really [zoom focus] which moves in the one zoom line top by which each lens group includes the zooming section and the focusing section by turns as a configuration for aiming at a miniaturization and cost cut of a zoom lens camera cone known conventionally. This example is explained below with reference to drawing 1 .
[0003] Drawing 1 is an example of the zoom diagram of 2 component zoom lens camera cone which performs focusing by the 1st lens group (the 1st component). This zoom lens camera cone contains fixed cylinder", "the immovable cam cylinder which carries out attitude migration relatively to a fixed cylinder", and immovable "1st and 2nd lens groups which carry out attitude migration relatively to a cam cylinder" to the body of "camera as well as the case of the operation gestalt of this invention explained later.
[0004] In drawing 1 (a), the straight line 1 shows the delivery lead of the 2nd lens group [as opposed to / in the stair-like line 2 / a cam cylinder for the delivery lead of the 1st lens group / as opposed to / in a straight line 3 / a cam cylinder for the delivery lead of the cam cylinder to a fixed cylinder / (the 1st component)] (the 2nd component), respectively. Therefore, the amount of deliveries to the fixed cylinder of the 1st lens group becomes what compounded straight lines 1 and 3, and the straight line 13 in drawing 1 (b) expresses this. Similarly, the amount of deliveries to the fixed cylinder of the 2nd lens group becomes what compounded the straight line 1 and the stair-like line 2, and the stair-like line 12 in drawing 1 (b) expresses this.
[0005] A call, wideness, and four steps between them, i.e., the step zoom which performs zooming of six steps by all, are used for this zoom lens camera cone, focusing is performed in the part corresponding to a part for the horizontal level of the stair-like zoom line 12 (focusing section), and zooming is performed in other parts (zooming section). Thus, in a drive, each lens group really [zoom focus] moves in the one zoom line top which includes two or more zooming sections and two or more focusing sections by turns, respectively.
[0006] in addition -- drawing 1 -- (-- a --) -- inside -- a curve -- two -- ' -- continuation -- a zoom -- a case -- it can set -- a cam -- a cylinder -- receiving -- the -- two -- a lens -- a group (the 2nd component) -- delivery -- a lead -- being shown -- **** -- therefore -- the -- two -- a lens -- a group -- immobilization -- a cylinder -- receiving -- a delivery -- an amount -- drawing 1 -- (-- b --) -- it can set -- a curve -- 12 -- ' -- expressing -- having -- ******** . In the case of a continuation zoom, focusing in each zoom location is performed by changing the relative distance of both the lens group using other drives.
[0007] As shown in drawing 1 (b), while the 1st component is crossed to all zoom regions and always moves to a linear along with the zoom line 13, it does not move the 2nd component in

the direction of an optical axis in a part for the horizontal level in the stair-like zoom line 12 (focusing section). That is, "the rate of change of the relative distance of the 1st component and the 2nd component" to a fixed camera cone angle of rotation is the same about all the focusing sections.
[0008] on the other hand, generally it can say "even when change of the relative distance of the 1st component and the 2nd component is so the same that it goes to a call side from a wide side in a zoom lens camera cone, the movement magnitude of the focus location resulting from it becomes large." Therefore, it becomes so large that "the rate of change of the relative distance of the 1st component and the 2nd component" to a fixed camera cone angle of rotation as shown in drawing 1 really [same about all the focusing sections / conventional / zoom focus] goes to a movement magnitude's of focus location to same camera cone angle of rotation call side in a drive mold zoom lens camera cone, and for this reason, there is a problem that focus precision worsens, so that it goes to a call side.
[0009] in order to solve this problem -- the total rotation of a camera cone -- large -- carrying out -- focus doubling by the side of a call -- it is possible to raise resolution or to shorten the die length of the zooming section and to enlarge the camera cone rotation in the focusing section. However, if the total rotation of a camera cone is enlarged, the overall length of the cam groove (for example, cam groove 210 shown in drawing 2 -4) formed in a cam cylinder also becomes long, the reinforcement of a camera cone will fall [the part], or cam grooves will lap. Moreover, if the number of the zooming sections is reduced, the pressure angle in each zooming section will become large, consequently another problem that smooth rotation of a camera cone is barred or big driving force is needed for camera cone rotation will occur.
[0010]
[Problem(s) to be Solved by the Invention] Therefore, the technical technical problem which this invention should solve is a zoom camera which really [zoom focus] adopts a drive method, and is offering the zoom camera with which focus precision's does not get worse to a call side, without causing increase of the total rotation of a camera cone, and increase of the pressure angle in the zooming section.
[0011]
[Means for Solving the Problem and its Function and Effect] It is originated in order to solve the above-mentioned technical problem effectively, and this invention offers the zoom camera equipped with the following descriptions.
[0012] The zoom camera of this invention is really [zoom focus] which moves in the one zoom line top which includes the zooming section of two or more focusing sections and plurality respectively of two or more lens groups by turns equipped with a drive mold zoom lens camera cone. And it is characterized by constituting so that "the rate of change of the relative distance of both the lens group to a fixed camera cone angle of rotation" in each focusing section may become small [the focusing section by the side of a call] about "two lens groups to which the variation of the unit of the relative distance has biggest effect on the amount of focus impaction efficiency and which counters."
[0013] Generally, "the focus location (focus location) movement magnitude to relative-distance change of the unit of two lens groups which counter" becomes so large that it goes to a call (looking far) side from a wide (wide angle) side. On the other hand, "the amount of focus impaction efficiency to a fixed camera cone angle of rotation" is expressed with the product of "the focus location (focus location) movement magnitude to relative-distance change of the unit of two lens groups which counter", and "the rate of change of the relative distance of both the lens group to a fixed camera cone angle of rotation." therefore, "the amount of focus impaction efficiency to a fixed camera cone angle of rotation" can be made into about 1 law in all zoom regions by [which go "the rate of change of the relative distance of both the lens group to a fixed camera cone angle of rotation" to a call side] it being alike, and following and

setting up small. That is, it is lost that focus precision gets worse, so that it goes to a call side.
[0014] Only in the case of two, paying attention to the two lens groups, a lens group should just set up small "the rate of change of the relative distance of both the lens group to a fixed camera cone angle of rotation" as it goes to a call side. In a certain case, three or more lens groups perform the same setup paying attention to "that to which it is two lens groups which counter, and the variation of the unit of the relative distance has biggest effect on focus impaction efficiency." Although which combination has biggest effect on the amount of focus impaction efficiency changes with concrete lens configurations between two lens groups which counter, this invention contains those all.
[0015] Furthermore by this invention, in the above-mentioned zoom camera about two lens groups to which the variation of the unit of the relative distance has biggest effect on the amount of focus impaction efficiency and which counter The rate of change of the relative distance of both the lens group to the fixed camera cone angle of rotation in each focusing section constitutes so that the focusing section by the side of a call may become small. By this The approach of making regularity mostly the amount of focus impaction efficiency to a fixed camera cone angle of rotation in all zoom regions is offered.
[0016] As mentioned above, the zoom camera of this invention is constituted so that "the amount of focus impaction efficiency to a fixed camera cone angle of rotation" may become almost fixed in all zoom regions, and each lens group may move in a zoom line top. In this case, change of the relative distance of an a large number group as lens between groups (preferably all groups) as possible which counters regardless of the rate of change of a relative distance only about two specific lens groups in two or more lens groups is taken into consideration.
[0017] furthermore, you may constitute so that "the amount obtained by **(ing) the amount of focus impaction efficiency to a fixed camera cone angle of rotation with the F value of the zoom lens concerned" may serve as about 1 law in all zoom regions in this invention, and each lens group may move in a zoom line top. Since the focus width of face decided from the path of permissible circle of confusion permitted by each focal distance is proportional to an F value, if not only the amount of focus impaction efficiency but change of an F value is taken into consideration, it will become advantageous in respect of an angle of rotation, optimization of a cam, etc. Also in this case, change of the relative distance of an a large number group as lens between groups (preferably all groups) as possible is taken into consideration.
[0018]
[Embodiment of the Invention] With reference to the drawing of attachment of the 1st operation gestalt of this invention, it explains below at a detail. Drawing 2 is the sectional view of the camera cone in a collapsing position. 90 in drawing shows the outer shell which constitutes the front face of a camera body. The fixed cylinder 100 is being fixed to immobilization to the body of a camera, and the cam cylinder 200 is held inside this fixed cylinder 100. With the development view, the cam cylinder 200 has the helicoid gear 201 for the peripheral face in the photography person side edge section, as shown in drawing 5 . The helicoid gear 201 consists of "band-like gear section 201a formed over the perimeter of the cam cylinder 200", and "female helicoid section 201b formed by crossing this gear section 201a aslant." By receiving the driving force from the drive gear 150 in gear section 201a, the cam cylinder 200 rotates by the inside of the fixed cylinder 100.
[0019] Female helicoid section 201b engages with the male helicoid section 101 formed in the inner skin of the fixed cylinder 100. therefore, if the cam cylinder 200 rotates by the inside of the fixed cylinder 100, it will let out the cam cylinder 200 toward the front to the fixed cylinder 100 (namely, the body of a camera -- receiving). And the tele location of drawing 4 is arrived at through the wide location of drawing 3 . Thus, although the cam cylinder 200 carries out attitude migration in the direction of an optical axis along with the fixed cylinder 100, when the

cam cylinder 200 is in every location to the fixed cylinder 100, the overall length is almost equal to the die length of the fixed cylinder 100, and the drive gear 150 is carried out so that driving force can be transmitted. In addition, since the male helicoid section 101 is formed by the fixed lead angle over all zoom fields, the amount of deliveries of the cam cylinder 200 serves as linearity to the angle of rotation.

[0020] As shown in drawing 2 -4, where the rectilinear-propagation guidance cylinder 400 and the advance cylinder 300 are put together, it holds inside the cam cylinder 200. the rectilinear-propagation guidance cylinder 400 -- the cam cylinder 200 -- receiving -- relativity -- although it is rotatable, it is connected in the direction of an optical axis in the bayonet engagement section 401 so that being displaced relatively may become impossible. Moreover, the rectilinear-propagation guidance cylinder 400 is engaging with the rectilinear-propagation guide rail 102 of the flange 402 prepared in that photography person side edge section which 402a has projected on the radial outside in part, and this partial 402a prepared in the inside of the fixed cylinder 100. For this reason, the rectilinear-propagation guidance cylinder 400 can be displaced relatively in the direction of an optical axis impossible [relative rotation] to the fixed cylinder 100.

[0021] Therefore, although the rectilinear-propagation guidance cylinder 400 will carry out attitude migration in the direction of an optical axis with the cam cylinder 200 and the rectilinear-propagation guidance cylinder 400 concerned will carry out relative rotation to the cam cylinder 200 at this time if the cam cylinder 200 rotates by the inside of the fixed cylinder 100, relative rotation will be carried out to the fixed cylinder 100. In addition, two or more rectilinear-propagation guide rails 102 and flange lobe 402a are prepared in the hoop direction in fact, respectively, although only one ** has appeared in drawing 2 -4.

[0022] Although the advance cylinder 300 can move relatively [direction / of an optical axis] to the rectilinear-propagation guidance cylinder 400, it is improper for relative rotation. That is, since the rectilinear-propagation guidance cylinder 400 cannot be relative rotated to the fixed cylinder 100, it becomes impossible to the fixed cylinder 100 to also relative rotate the advance cylinder 300 after all. On the other hand, the predetermined helicoid section 350 is formed in the peripheral face of the advance cylinder 300, and this helicoid section engages with the predetermined helicoid section 230 formed in cam cylinder 200 inner skin. Therefore, if the cam cylinder 200 rotates by the inside of the fixed cylinder 100, the advance cylinder 300 will be guided by the interaction between helicoids at the rectilinear-propagation guidance cylinder 400, and predetermined attitude migration will be performed in the direction of an optical axis to the cam cylinder 200. And the relative movement magnitude to the fixed cylinder 100 of the advance cylinder 300 will be expressed with the sum of "the amount of optical-axis directional movements of the cam cylinder 200 to the fixed cylinder 100", and the "amount of optical-axis directional movements of the advance cylinder 300 to the cam cylinder 200." In addition, as shown in drawing 2 -4, since this advance cylinder 300 holds the 1st lens group 500 in one through a housing 501 (focal lens group housing), the behavior of the advance cylinder 300 turns into the behavior of the 1st lens group 500 itself.

[0023] Next, the behavior of the 2nd lens group 600 (the 2nd component) is explained. The follower pin 602 which projects in a radial is being engaged from the lens mounting rim 601 holding the 2nd lens group 600 in the cam groove 210 of the predetermined configuration formed in the inner skin of the cam cylinder 200. In each sectional view of drawing 2 -4, although only one has appeared, three follower pins have projected the follower pin 602 from the peripheral surface of the ring-like lens mounting rim 601 in fact. On the other hand, three rectilinear-propagation guidance slots 301 prolonged in the shape of a straight line are formed in the direction of an optical axis at the peripheral wall of the advance cylinder 300 corresponding to each follower pin. In each sectional view of drawing 2 -4, only one of them has appeared like [the rectilinear-propagation guidance slot 301] the follower pin 602.

[0024] As already explained, even when the cam cylinder 200 carries out relative rotation to the fixed cylinder 100, the advance cylinder 300 does not carry out relative rotation to the fixed cylinder 100. In other words, the cam cylinder 200 and the advance cylinder 300 carry out relative rotation. Therefore, if the cam cylinder 200 rotates, the follower pin 602 which engages with both the rectilinear-propagation guidance slot 301 formed in the advance cylinder 300 and the cam groove 210 formed in the inner skin of the cam cylinder 200 will be guided at the rectilinear-propagation guidance slot 301, and will be displaced relatively in the direction of an optical axis to the cam cylinder 200. Since cam cylinder 200 self is also displaced relatively to the fixed cylinder 100, the relative movement magnitude to the fixed cylinder 100 of the 2nd lens group 600 held after all at the lens mounting rim 601 equipped with the follower pin 602 will be expressed with the sum of "the amount of optical-axis directional movements of the cam cylinder 200 to the fixed cylinder 100", and the "amount of optical-axis directional movements of a lens mounting rim 601 to the cam cylinder 200."

[0025] The movement magnitude of the 1st lens group 500 to the fixed cylinder 100 can be defined with "the configuration of each helicoid sections 230 and 350 which determine the relative displacement of the cam cylinder 200 and the advance cylinder 300" so that the above explanation may show. Moreover, the movement magnitude of the 2nd lens group 600 to the fixed cylinder 100 can be defined with "the configuration of the cam groove 210 which determines the relative displacement of the cam cylinder 200 and a lens mounting rim 601." In other words, the zoom lens camera cone which has various zoom lines can be constituted by changing suitably the configuration of each above-mentioned helicoid section and a cam groove.

TECHNICAL FIELD

[Field of the Invention] This invention relates to the camera of the zoom focus type which performs zooming and focusing with a single drive.

[Translation done.]

PRIOR ART

[Description of the Prior Art] The drive is really [zoom focus] which moves in the one zoom line top by which each lens group includes the zooming section and the focusing section by turns as a configuration for aiming at a miniaturization and cost cut of a zoom lens camera cone known conventionally. This example is explained below with reference to drawing 1 .
[0003] Drawing 1 is an example of the zoom diagram of 2 component zoom lens camera cone which performs focusing by the 1st lens group (the 1st component). This zoom lens camera cone contains fixed cylinder", "the immovable cam cylinder which carries out attitude migration relatively to a fixed cylinder", and immovable "1st and 2nd lens groups which carry out attitude migration relatively to a cam cylinder" to the body of "camera as well as the case of the operation gestalt of this invention explained later.
[0004] In drawing 1 (a), the straight line 1 shows the delivery lead of the 2nd lens group [as opposed to / in the stair-like line 2 / a cam cylinder for the delivery lead of the 1st lens group / as opposed to / in a straight line 3 / a cam cylinder for the delivery lead of the cam cylinder to a fixed cylinder / (the 1st component)] (the 2nd component), respectively. Therefore, the amount of deliveries to the fixed cylinder of the 1st lens group becomes what compounded straight lines 1 and 3, and the straight line 13 in drawing 1 (b) expresses this. Similarly, the amount of deliveries to the fixed cylinder of the 2nd lens group becomes what compounded the straight line 1 and the stair-like line 2, and the stair-like line 12 in drawing 1 (b) expresses this.
[0005] A call, wideness, and four steps between them, i.e., the step zoom which performs zooming of six steps by all, are used for this zoom lens camera cone, focusing is performed in the part corresponding to a part for the horizontal level of the stair-like zoom line 12 (focusing section), and zooming is performed in other parts (zooming section). Thus, in a drive, each lens group really [zoom focus] moves in the one zoom line top which includes two or more zooming sections and two or more focusing sections by turns, respectively.
[0006] in addition -- drawing 1 -- (-- a --) -- inside -- a curve -- two -- ' -- continuation -- a zoom -- a case -- it can set -- a cam -- a cylinder -- receiving -- the -- two -- a lens -- a group (the 2nd component) -- delivery -- a lead -- being shown -- **** -- therefore -- the -- two -- a lens -- a group -- immobilization -- a cylinder -- receiving -- a delivery -- an amount -- drawing 1 -- (-- b --) -- it can set -- a curve -- 12 -- ' -- expressing -- having -- ******** . In the case of a continuation zoom, focusing in each zoom location is performed by changing the relative distance of both the lens group using other drives.
[0007] As shown in drawing 1 (b), while the 1st component is crossed to all zoom regions and always moves to a linear along with the zoom line 13, it does not move the 2nd component in the direction of an optical axis in a part for the horizontal level in the stair-like zoom line 12 (focusing section). That is, "the rate of change of the relative distance of the 1st component and the 2nd component" to a fixed camera cone angle of rotation is the same about all the focusing sections.
[0008] on the other hand, generally it can say "even when change of the relative distance of

the 1st component and the 2nd component is so the same that it goes to a call side from a wide side in a zoom lens camera cone, the movement magnitude of the focus location resulting from it becomes large." Therefore, it becomes so large that "the rate of change of the relative distance of the 1st component and the 2nd component" to a fixed camera cone angle of rotation as shown in drawing 1 really [same about all the focusing sections / conventional / zoom focus] goes to a movement magnitude's of focus location to same camera cone angle of rotation call side in a drive mold zoom lens camera cone, and for this reason, there is a problem that focus precision worsens, so that it goes to a call side.
[0009] in order to solve this problem -- the total rotation of a camera cone -- large -- carrying out -- focus doubling by the side of a call -- it is possible to raise resolution or to shorten the die length of the zooming section and to enlarge the camera cone rotation in the focusing section. However, if the total rotation of a camera cone is enlarged, the overall length of the cam groove (for example, cam groove 210 shown in drawing 2 -4) formed in a cam cylinder also becomes long, the reinforcement of a camera cone will fall [the part], or cam grooves will lap. Moreover, if the number of the zooming sections is reduced, the pressure angle in each zooming section will become large, consequently another problem that smooth rotation of a camera cone is barred or big driving force is needed for camera cone rotation will occur.

[Translation done.]

EFFECT OF THE INVENTION

[Means for Solving the Problem and its Function and Effect] It is originated in order to solve the above-mentioned technical problem effectively, and this invention offers the zoom camera equipped with the following descriptions.
[0012] The zoom camera of this invention is really [zoom focus] which moves in the one zoom line top which includes the zooming section of two or more focusing sections and plurality respectively of two or more lens groups by turns equipped with a drive mold zoom lens camera cone. And it is characterized by constituting so that "the rate of change of the relative distance of both the lens group to a fixed camera cone angle of rotation" in each focusing section may become small [the focusing section by the side of a call] about "two lens groups to which the variation of the unit of the relative distance has biggest effect on the amount of focus impaction efficiency and which counters."
[0013] Generally, "the focus location (focus location) movement magnitude to relative-distance change of the unit of two lens groups which counter" becomes so large that it goes to a call (looking far) side from a wide (wide angle) side. On the other hand, "the amount of focus impaction efficiency to a fixed camera cone angle of rotation" is expressed with the product of "the focus location (focus location) movement magnitude to relative-distance change of the unit of two lens groups which counter", and "the rate of change of the relative distance of both the lens group to a fixed camera cone angle of rotation." therefore, "the amount of focus impaction efficiency to a fixed camera cone angle of rotation" can be made into about 1 law in all zoom regions by [which go "the rate of change of the relative distance of both the lens group to a fixed camera cone angle of rotation" to a call side] it being alike, and following and setting up small. That is, it is lost that focus precision gets worse, so that it goes to a call side.
[0014] Only in the case of two, paying attention to the two lens groups, a lens group should just set up small "the rate of change of the relative distance of both the lens group to a fixed camera cone angle of rotation" as it goes to a call side. In a certain case, three or more lens groups perform the same setup paying attention to "that to which it is two lens groups which counter, and the variation of the unit of the relative distance has biggest effect on focus impaction efficiency." Although which combination has biggest effect on the amount of focus impaction efficiency changes with concrete lens configurations between two lens groups which counter, this invention contains those all.
[0015] Furthermore by this invention, in the above-mentioned zoom camera about two lens groups to which the variation of the unit of the relative distance has biggest effect on the amount of focus impaction efficiency and which counter The rate of change of the relative distance of both the lens group to the fixed camera cone angle of rotation in each focusing section constitutes so that the focusing section by the side of a call may become small. By this The approach of making regularity mostly the amount of focus impaction efficiency to a fixed camera cone angle of rotation in all zoom regions is offered.
[0016] As mentioned above, the zoom camera of this invention is constituted so that "the

amount of focus impaction efficiency to a fixed camera cone angle of rotation" may become almost fixed in all zoom regions, and each lens group may move in a zoom line top. In this case, change of the relative distance of an a large number group as lens between groups (preferably all groups) as possible which counters regardless of the rate of change of a relative distance only about two specific lens groups in two or more lens groups is taken into consideration.

[0017] furthermore, you may constitute so that "the amount obtained by **(ing) the amount of focus impaction efficiency to a fixed camera cone angle of rotation with the F value of the zoom lens concerned" may serve as about 1 law in all zoom regions in this invention, and each lens group may move in a zoom line top. Since the focus width of face decided from the path of permissible circle of confusion permitted by each focal distance is proportional to an F value, if not only the amount of focus impaction efficiency but change of an F value is taken into consideration, it will become advantageous in respect of an angle of rotation, optimization of a cam, etc. Also in this case, change of the relative distance of an a large number group as lens between groups (preferably all groups) as possible is taken into consideration.

[0018]

[Embodiment of the Invention] With reference to the drawing of attachment of the 1st operation gestalt of this invention, it explains below at a detail. Drawing 2 is the sectional view of the camera cone in a collapsing position. 90 in drawing shows the outer shell which constitutes the front face of a camera body. The fixed cylinder 100 is being fixed to immobilization to the body of a camera, and the cam cylinder 200 is held inside this fixed cylinder 100. With the development view, the cam cylinder 200 has the helicoid gear 201 for the peripheral face in the photography person side edge section, as shown in drawing 5 . The helicoid gear 201 consists of "band-like gear section 201a formed over the perimeter of the cam cylinder 200", and "female helicoid section 201b formed by crossing this gear section 201a aslant." By receiving the driving force from the drive gear 150 in gear section 201a, the cam cylinder 200 rotates by the inside of the fixed cylinder 100.

[0019] Female helicoid section 201b engages with the male helicoid section 101 formed in the inner skin of the fixed cylinder 100. therefore, if the cam cylinder 200 rotates by the inside of the fixed cylinder 100, it will let out the cam cylinder 200 toward the front to the fixed cylinder 100 (namely, the body of a camera -- receiving). And the tele location of drawing 4 is arrived at through the wide location of drawing 3 . Thus, although the cam cylinder 200 carries out attitude migration in the direction of an optical axis along with the fixed cylinder 100, when the cam cylinder 200 is in every location to the fixed cylinder 100, the overall length is almost equal to the die length of the fixed cylinder 100, and the drive gear 150 is carried out so that driving force can be transmitted. In addition, since the male helicoid section 101 is formed by the fixed lead angle over all zoom fields, the amount of deliveries of the cam cylinder 200 serves as linearity to the angle of rotation.

[0020] As shown in drawing 2 -4, where the rectilinear-propagation guidance cylinder 400 and the advance cylinder 300 are put together, it holds inside the cam cylinder 200. the rectilinear-propagation guidance cylinder 400 -- the cam cylinder 200 -- receiving -- relativity -- although it is rotatable, it is connected in the direction of an optical axis in the bayonet engagement section 401 so that being displaced relatively may become impossible. Moreover, the rectilinear-propagation guidance cylinder 400 is engaging with the rectilinear-propagation guide rail 102 of the flange 402 prepared in that photography person side edge section which 402a has projected on the radial outside in part, and this partial 402a prepared in the inside of the fixed cylinder 100. For this reason, the rectilinear-propagation guidance cylinder 400 can be displaced relatively in the direction of an optical axis impossible [relative rotation] to the fixed cylinder 100.

[0021] Therefore, although the rectilinear-propagation guidance cylinder 400 will carry out

attitude migration in the direction of an optical axis with the cam cylinder 200 and the rectilinear-propagation guidance cylinder 400 concerned will carry out relative rotation to the cam cylinder 200 at this time if the cam cylinder 200 rotates by the inside of the fixed cylinder 100, relative rotation will be carried out to the fixed cylinder 100. In addition, two or more rectilinear-propagation guide rails 102 and flange lobe 402a are prepared in the hoop direction in fact, respectively, although only one ** has appeared in drawing 2 -4.
[0022] Although the advance cylinder 300 can move relatively [direction / of an optical axis] to the rectilinear-propagation guidance cylinder 400, it is improper for relative rotation. That is, since the rectilinear-propagation guidance cylinder 400 cannot be relative rotated to the fixed cylinder 100, it becomes impossible to the fixed cylinder 100 to also relative rotate the advance cylinder 300 after all. On the other hand, the predetermined helicoid section 350 is formed in the peripheral face of the advance cylinder 300, and this helicoid section engages with the predetermined helicoid section 230 formed in cam cylinder 200 inner skin. Therefore, if the cam cylinder 200 rotates by the inside of the fixed cylinder 100, the advance cylinder 300 will be guided by the interaction between helicoids at the rectilinear-propagation guidance cylinder 400, and predetermined attitude migration will be performed in the direction of an optical axis to the cam cylinder 200. And the relative movement magnitude to the fixed cylinder 100 of the advance cylinder 300 will be expressed with the sum of "the amount of optical-axis directional movements of the cam cylinder 200 to the fixed cylinder 100", and the "amount of optical-axis directional movements of the advance cylinder 300 to the cam cylinder 200." In addition, as shown in drawing 2 -4, since this advance cylinder 300 holds the 1st lens group 500 in one through a housing 501 (focal lens group housing), the behavior of the advance cylinder 300 turns into the behavior of the 1st lens group 500 itself.
[0023] Next, the behavior of the 2nd lens group 600 (the 2nd component) is explained. The follower pin 602 which projects in a radial is being engaged from the lens mounting rim 601 holding the 2nd lens group 600 in the cam groove 210 of the predetermined configuration formed in the inner skin of the cam cylinder 200. In each sectional view of drawing 2 -4, although only one has appeared, three follower pins have projected the follower pin 602 from the peripheral surface of the ring-like lens mounting rim 601 in fact. On the other hand, three rectilinear-propagation guidance slots 301 prolonged in the shape of a straight line are formed in the direction of an optical axis at the peripheral wall of the advance cylinder 300 corresponding to each follower pin. In each sectional view of drawing 2 -4, only one of them has appeared like [the rectilinear-propagation guidance slot 301] the follower pin 602.
[0024] As already explained, even when the cam cylinder 200 carries out relative rotation to the fixed cylinder 100, the advance cylinder 300 does not carry out relative rotation to the fixed cylinder 100. In other words, the cam cylinder 200 and the advance cylinder 300 carry out relative rotation. Therefore, if the cam cylinder 200 rotates, the follower pin 602 which engages with both the rectilinear-propagation guidance slot 301 formed in the advance cylinder 300 and the cam groove 210 formed in the inner skin of the cam cylinder 200 will be guided at the rectilinear-propagation guidance slot 301, and will be displaced relatively in the direction of an optical axis to the cam cylinder 200. Since cam cylinder 200 self is also displaced relatively to the fixed cylinder 100, the relative movement magnitude to the fixed cylinder 100 of the 2nd lens group 600 held after all at the lens mounting rim 601 equipped with the follower pin 602 will be expressed with the sum of "the amount of optical-axis directional movements of the cam cylinder 200 to the fixed cylinder 100", and the "amount of optical-axis directional movements of a lens mounting rim 601 to the cam cylinder 200."
[0025] The movement magnitude of the 1st lens group 500 to the fixed cylinder 100 can be defined with "the configuration of each helicoid sections 230 and 350 which determine the relative displacement of the cam cylinder 200 and the advance cylinder 300" so that the above explanation may show. Moreover, the movement magnitude of the 2nd lens group 600 to the

fixed cylinder 100 can be defined with "the configuration of the cam groove 210 which determines the relative displacement of the cam cylinder 200 and a lens mounting rim 601." In other words, the zoom lens camera cone which has various zoom lines can be constituted by changing suitably the configuration of each above-mentioned helicoid section and a cam groove. This invention chooses those configurations suitably, it sets them up so that the relative displacement (configuration of a zoom diagram) of each lens group may be explained below, and thereby, its movement magnitude of the focus location to a fixed camera cone angle of rotation is almost equal in all zoom regions, or it is constituted so that it may be proportional to the F value of the zoom lens concerned. Conversely, if it says, in this invention, it will not be limited especially about becoming the configuration which the zoom diagram itself explains below adopting the helicoid section and the cam groove of what kind of configuration concretely importantly therefore. Each zoom line explained below shows the synthetic movement magnitude to the body of a camera of each lens group resulting from each helicoid, a cam, etc. which were formed in two or more members which constitute a camera cone.
[0026] (The 1st operation gestalt) Drawing 6 shows the 1st operation gestalt of the zoom diagram by this invention. In the example of drawing 6 , the zoom lens camera cone has the 1st and 2nd lens groups, and the 2nd lens group moves the 1st lens group along with the zoom line 22 along with the zoom line 21, respectively. This zoom lens camera cone has the level zoom line 22 in the focusing section. That is, it is the type which the 2nd lens group does not move in the direction of an optical axis, but performs focusing only by the 1st lens group at the time of focusing.
[0027] The description of the zoom diagram of drawing 6 is so small that the inclination of the zoom line 21 in each focusing section goes to the focusing section by the side of a call. That is, since the zoom line 22 is a horizontal altogether in each focusing section, when "the rate of change of the relative distance of both the lens group to a fixed camera cone angle of rotation" is set to A, I hear that it is so small that the value of this A becomes the focusing section by the side of a call, and there is.
[0028] On the other hand, generally, if "focus location (focus location) movement magnitude to relative-distance change of the unit of both the lens group" is set to B, the value of this B will become so large that it goes to a call side. since "the amount of focus impaction efficiency to a fixed camera cone angle of rotation" is expressed with AxB, it can make the value of AxB about 1 law in all zoom regions by [which go to a value of A call-side] it being alike, and following and setting up small. In addition, when considering strictly "the amount of focus impaction efficiency to a fixed camera cone angle of rotation", it is desirable to take not only the value change of Above B but change of Fno (F value) of a zoom lens into consideration. In this case, if B'=B/Fno, it will become so large that the value of B' also goes to a call side in many cases. therefore, the value of AxB' can be made into about 1 law in all zoom regions by [which go to a value of A call-side too] it being alike, and following and setting up small. On the other hand, it will become so large that the value of A goes to a value's of AxB (or AxB"s) call side by the conventional zoom lens camera cone shown in fixed drawing 1 in all zoom regions.
[0029] (The 2nd operation gestalt) Although two lens groups exist like the case of drawing 6 in the example of drawing 7 , it differs from the case of drawing 6 at the point which both the 1st lens group and the 2nd lens group move in the direction of an optical axis at the time of focusing. The 1st lens group moves the 2nd lens group along with the zoom line 32 along with the zoom line 31, respectively.
[0030] Since it was only the 1st lens which is moved in the direction of an optical axis in the example of drawing 6 in the focusing section, "relative-distance change of both the lens group" affected the amount of focus impaction efficiency. On the other hand, in both the examples of drawing 7 , in order that both lens groups may move in the focusing section, "not only relative-

distance change of both the lens group" but "distance change between the 2nd lens group and a film plane" will affect the amount of focus impaction efficiency. Therefore, it is ideal to determine the zoom diagram of each lens group in consideration of the effect of these both. However, since the effect by "distance change between the 2nd lens group and a film plane" is small compared with the effect by "relative-distance change of both the lens group", in the example of drawing 7 R> 7, it thinks paying attention to "relative-distance change of both the lens group."

[0031] In the example of drawing 7 , in order that the 1st lens group may always move to a linear over all zoom regions, the zoom line 31 has the fixed inclination. On the other hand, the inclination of the zoom line 32 is zero (level) most in the focusing section by the side of wide. For this reason, it is designing so that the focusing section by the side of a call comes, and the inclination of the zoom line 32 may approach the inclination of the zoom line 31, and the focusing section by the side of a call of the inclination of the zoom line 32 may become large in each focusing section. Thereby, the difference of the zoom line 31 and the inclination of 32 of the focusing section by the side of a call becomes small, therefore the value of the above-mentioned rate of change A becomes small. On the other hand, contrary to drawing 7 , it is the case where photography distance shifts to infinite distance from the shortest in each focusing section as a camera cone lets out drawing 8 which is a modification over this. In this case, since the inclination of zoom line 32' is set up most in the focusing section by the side of wide more greatly than the inclination of zoom line 31', it is designing so that it goes to the focusing section by the side of a call, and rate of change A may become small, and the focusing section by the side of a call of the inclination of zoom diagram 32' in each focusing section may become small.

[0032] (The 3rd operation gestalt) The zoom lens camera cone is equipped with three lens groups, the 1st, the 2nd, and the 3rd, and the 3rd lens group moves the 2nd lens group for the 1st lens group along with the zoom line 43 along with the zoom line 42 along with the zoom line 41 in the example of drawing 9 , respectively. This zoom lens camera cone has the level zoom diagrams 41 and 43 in the focusing section. That is, it is the type which the 1st and 3rd lens groups do not move in the direction of an optical axis, but performs focusing only by the 2nd lens group at the time of focusing.

[0033] Since one pair of lens groups [2 sets of] which counter will exist when the number of lens groups is three, it is ideal to determine the zoom diagram of each lens group in consideration of the amount of focus impaction efficiency and the variation of an F value to change of the relative distance of 2 sets of lens groups concerned (also in case of the same as when a lens group is four or more). However, in the example of drawing 9 , the same view as the case where the number of lens groups as shown in drawing 6 - drawing 8 is two is adopted about the two lens groups paying attention to "that to which it is two lens groups which counter, and the variation of the unit of the relative distance has biggest effect on focus impaction efficiency" for simplification. That is, "the rate of change A of the relative distance of both the lens group to a fixed camera cone angle of rotation" is made so small that the focusing section by the side of a call comes about such two lens groups that counter. In addition, which shall have big effect with the amount of focus impaction efficiency between "the variation of the relative distance of the unit of the 1st lens group and the 2nd lens group" and "the variation of the relative distance of the unit of the 2nd lens group and the 3rd lens group" changes with configurations of each concrete lens group. Drawing 9 is an example when the effect by the 2nd lens group and the 3rd lens group is large. Even when a lens group is set or more to four, it thinks the same way. Moreover, it is possible that a lens group is equivalent to the "thing to which it is two lens groups which counter, and the variation of the unit of the relative distance has biggest effect on focus impaction efficiency" with the two above-mentioned lens groups only in the case of two.

[0034] If it is considered the case of drawing 6 the same way paying attention to the 2nd lens group and the 3rd lens group, it is required to make it so small that it go to the focusing section by the side of a call of the inclination of the zoom line 42 in each focusing section. It actually turns out that the zoom line 42 in drawing 9 R> 9 is constituted such. Thereby, the value of AxB (or AxB') can be set almost constant in all zoom regions like the case of drawing 6 .
[0035] (The 4th operation gestalt) Although three lens groups exist like the case of drawing 9 in the example of drawing 10, it differs from the case of drawing 9 at the point which all the 1-3rd groups move in the direction of an optical axis at the time of focusing. In the 1st lens group, along with the zoom line 51, the 2nd lens group moves the 3rd lens group along with the zoom line 53 along with the zoom line 52, respectively.
[0036] Since it was only the 2nd lens group which is moved in the direction of an optical axis in the example of drawing 9 in the focusing section, "relative-distance change of each lens group" affected the amount of focus impaction efficiency. On the other hand, in the example of drawing 10, in order that the 3rd lens group may also move in the focusing section, "distance change between the 3rd lens group and a film plane" will affect the amount of focus impaction efficiency. Therefore, it is ideal to determine the zoom diagram of each lens group in consideration of all the effect of these. However, "distance change between the 3rd lens group and a film plane" is disregarded also here by the reason same with "distance change between the 2nd lens group and a film plane" having been disregarded in the example of drawing 7 and drawing 8 R> 8. Moreover, relative-distance change with the 2nd lens group and the 3rd lens group thinks like the case of the example of drawing 9 as what has big effect with the amount of focus impaction efficiency.
[0037] In the example of drawing 10, the 3rd lens group always moves to a linear in all zoom regions. Therefore, like the case of drawing 7 , it is designing so that the focusing section by the side of a call comes, and the inclination of the zoom line 52 may approach the inclination of the zoom line 53, and the focusing section by the side of a call of the inclination of the zoom line 52 may become large in each focusing section. Thereby, the difference of the zoom line 52 and the inclination of 53 of the focusing section by the side of a call becomes small, therefore the value of the above-mentioned rate of change A becomes small.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Therefore, the technical technical problem which this invention should solve is a zoom camera which really [zoom focus] adopts a drive method, and is offering the zoom camera with which focus precision's does not get worse to a call side, without causing increase of the total rotation of a camera cone, and increase of the pressure angle in the zooming section.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is really [conventional / zoom focus] which performs focusing by the 1st lens group and performs zooming by the 2nd lens group, respectively a zoom diagram in a drive type camera.
[Drawing 2] It is the sectional view showing the zoom lens camera cone concerning the camera of this invention in a collapsing position.
[Drawing 3] It is the sectional view showing the zoom lens camera cone of drawing 2 in a wide location.
[Drawing 4] It is the sectional view showing the zoom lens camera cone of drawing 2 in a tele location.
[Drawing 5] It is a development view explaining the outside configuration of the cam cylinder contained in the zoom lens camera cone of drawing 2 .
[Drawing 6] It is the zoom diagram of the camera concerning the 1st operation gestalt of this invention.
[Drawing 7] It is the zoom diagram of the camera concerning the 2nd operation gestalt of this invention.
[Drawing 8] It is the zoom diagram of a modification to the zoom diagram of drawing 7 .
[Drawing 9] It is the zoom diagram of the camera concerning the 3rd operation gestalt of this invention.
[Drawing 10] It is the zoom diagram of the camera concerning the 4th operation gestalt of this invention.
[Description of Notations]
90 Front Face of Camera Body
100 Fixed Cylinder
101 Male Helicoid Section
102 Rectilinear-Propagation Guide Rail
150 Drive Gear
200 Cam Cylinder
201 Helicoid Gear
201a Gear section
201b Female helicoid section
210 Cam Groove
230 Helicoid Section
300 Advance Cylinder
301 Rectilinear-Propagation Guidance Slot
350 Helicoid Section
400 Rectilinear-Propagation Guidance Cylinder
401 Bayonet Engagement Section

402 Flange
500 1st Lens Group (Compensator)
501 Housing
600 2nd Lens Group (BARIETA)
601 Lens Mounting Rim
602 Follower Pin

[Translation done.]